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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/621,018

07/16/2003

Frank E. Anderson

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LEXMARK INTERNATIONAL, INC.
INTELLECTUAL PROPERTY LAW DEPARTMENT
740 WEST NEW CIRCLE ROAD
BLDG. 082-1
LEXINGTON, KY 40550-0999

EXAMINER

GORDON, RAQUEL YVETTE

ART UNIT

PAPER NUMBER

2853

DATE MAILED: 10/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/621,018

Applicant(s)

ANDERSON, FRANK

Examiner

Raquel Y. Gordon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 7/16/2003 (this application).
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 22-28 and 36-38 is/are allowed.
- 6) ☒ Claim(s) 1-18, 20, 21 and 29-32 is/are rejected.
- 7) ☒ Claim(s) 19 and 33-35 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- 1) ☐ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>7/16/2003</u> . | 6) <input type="checkbox"/> Other: _____ |

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Stephens, Jr. et al. (US006179401B1).

Stephens, Jr. et al. teach every element of the instant claims including:

1. An ink jet printer comprising a printer cartridge containing a printhead attached to a cartridge carriage (70, 72, 74, 76) for translation of the cartridge across a print media, an off carriage ink supply, a printer microprocessor (272), and a combined ink fill tube (150, 152, 154, 156) and electrical connection cable connected between the cartridge and the off carriage ink supply for providing refill ink to the ink cartridge and control of the carriage and printhead (106);
2. The ink jet printer of claim 1 wherein the combined ink fill tube (150, 152, 154, 156) and electrical connection cable is attached to the carriage and a refill tube is

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connected between the cartridge and carriage for providing ink to the cartridge (70, 72, 75, 76);

3. The ink jet printer of claim 1 wherein the ink cartridge further comprises a cartridge body containing an ink reservoir and a pressure regulator for controlling refill of the ink reservoir within the cartridge body (col 6, lns 28-47);

7. The ink jet printer of claim 1 wherein the printhead comprises a shelf-less heater chip having ink channels etched into a surface of the chip (col 4, lns 23-25).

Claims 8-11, 13-16, 18, 20, and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Cornell et al. (US006637866B1).

Cornell et al. teach every element of the instant claims including:

8. A printhead for an ink jet printer comprising a semiconductor substrate (18), a first insulating layer deposited on the substrate (20), a first conductive layer (22) deposited on the insulating layer (20 and col 5, lns 55-63), wherein the first conductive layer is etched (col 5, ln 65-col 6, ln 13) to define an ink ejector location between opposed portions of the first conductive layer (col 5, ln 65-col 6, ln 13), a diamondlike-carbon (DLC) layer deposited in the ink ejector location and on at least a portion of the first conductive layer, a second insulating layer deposited on the opposed portions of the first conductive layer, and a second conductive layer deposited on at least a portion of the second insulating layer, wherein the DLC layer contains an upper doped or undoped layer and a lower

layer doped with a material sufficient to provide increasing conductivity thereto thereby defining ink ejection devices (col 5, ln 65-col 6, ln 54);

9. The printhead of claim 8 wherein the DLC layer comprises a boron-doped DLC layer portion deposited in the ink ejector location and a silicon-doped DLC layer portion provided as an island (21) substantially between the opposed portions of the first conductive layer (col 5, ln 47-67);

10. The printhead of claim 8 wherein the undoped-DLC layer spans multiple ink ejection devices (21);

11. The printhead of claim 8 further comprising a smoothing layer deposited on the upper DLC layer (Abstract, 32);

13. The printhead of claim 8 wherein the second insulating layer comprises an intermetal dielectric layer made of DLC having a thickness ranging from about 1000 to about 3000 angstroms (col 4, ln 60-62);

14. A printhead for an ink jet printer comprising a semiconductor substrate (18) having a device surface including a first insulating layer (20) deposited on the substrate, a resistive layer deposited on the first insulating layer (col 5, ln 65-col 6, ln 13, col 6, ln 23-25, and col 6, ln 13-18), a first conductive layer deposited on the resistive layer, wherein the first conductive layer (22) is etched to define an ink ejector location between opposed portions of the first conductive layer, a

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diamondlike-carbon (DLC) protective layer deposited on the device surface over the first insulating, resistive and first conductive layers (col 5, ln 65-col 6, ln 13), a second insulating layer deposited on the opposed portions of the first conductive layer, and a second conductive layer deposited on at least a portion of the second insulating layer, wherein a portion of the DLC protective layer is doped to improve adhesion between the first conductive layer and the second insulating layer (col 5, ln 65-col 6, ln 54);

15. The printhead of claim 14 wherein the DLC protective layer is doped with titanium in the ink ejector location to provide enhanced corrosion resistance (col 7, lns 4-12);

16. The printhead of claim 14 wherein the DLC protective layer comprises a lower silicon doped (DLC) layer and an upper undoped DLC layer (col 5, lns 43-65 and col 6, lns 1-54);

18. The printhead of claim 14 wherein the second insulating layer comprises an intermetal dielectric layer made of DLC having a thickness ranging from about 1000 to about 3000 angstroms (col 4, ln 60-62);

20. The printhead of claim 14 wherein the semiconductor substrate has a thickness ranging from about 10 to less than about 500 microns (col 9, lns 5-13);

21. The printhead of claim 14 wherein the semiconductor substrate comprises a non-epitaxial silicon substrate (col 5, lns 1-22).

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The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Claims 29 and 30 are rejected under 35 U.S.C. 102(b) as being anticipated by Asaba (US005850242A).

Asaba teaches every element of the instant claims including:

29. A printhead for an ink jet printer comprising a semiconductor chip containing a plurality of heater resistors for ink ejection, a power field effect transistors (FET's) for driving each heater resistor, and CMOS logic devices coupled to the FET's and heater resistors, wherein a gate oxide layer for gates of the FET's has a thickness greater than a gate oxide layer for gates of the CMOS logic devices (col 3, Ins 49-65);

30. The printhead of claim 29 wherein the chip further comprises a plurality of fuses as memory elements, the fuses being formed from a tantalum tantalum/aluminum composite material (col 4, Ins 15-25).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stephens, Jr. et al. in view of Silverbrook (US Pub No. 20040113988 A1).

Stephens, Jr. et al. teach every element of the instant invention except:

4. The ink jet printer of claim 3 wherein the pressure regulator comprises gas filled microcapsules;

5. The ink jet printer of claim 1 wherein the printhead contains ink ejectors for ejecting a mass of ink ranging from about 0.2 to about 1 nanogram.

Nevertheless, Silverbrook teaches:

4. The ink jet printer of claim 3 wherein the pressure regulator comprises gas filled microcapsules (§ 0137);

5. The ink jet printer of claim 1 wherein the printhead contains ink ejectors for ejecting a mass of ink ranging from about 0.2 to about 1 nanogram (abstract and (§ 0137)).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Stephens, Jr. et al. by the aforementioned teachings of Silverbrook for the purpose of providing efficient operation using less energy, as taught by Silverbrook

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stephens, Jr. et al. in view of Cornell et al.

Stephens Jr. et al. teach every element of the instant claims except :

6. The ink jet printer of claim 1 wherein the printhead comprises an ultra-thin semiconductor material having a thickness ranging from about 10 microns to less than about 500 microns.

Nevertheless, Cornell et al. teach:

6. The ink jet printer of claim 1 wherein the printhead comprises an ultra-thin semiconductor material having a thickness ranging from about 10 microns to less than about 500 microns (col 9, lns 5-13).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Stephens, Jr. et al. by the aforementioned teachings of Cornell et al. for the purpose of improving the chip heater, as taught by Cornell et al.

Claims 12 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cornell et al. in view of Silverbrook (US Pub No. 20040113988 A1).

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Cornell et al. teach every element of the instant claim except:

12. The printhead of claim 8 wherein the ink ejector is configured for ejecting a mass of ink ranging from about 0.2 to about 1 nanogram;

17. The printhead of claim 14 wherein ink ejectors in each ink ejector location are configured for ejecting a mass of ink ranging from about 0.2 to about 1 nanogram.

Nevertheless, Silverbrook teaches:

12. The printhead of claim 8 wherein the ink ejector is configured for ejecting a mass of ink ranging from about 0.2 to about 1 nanogram (Abstract, ¶0137);

17. The printhead of claim 14 wherein ink ejectors in each ink ejector location are configured for ejecting a mass of ink ranging from about 0.2 to about 1 nanogram (Abstract, ¶0137).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Cornell et al. by the aforementioned teachings of Silverbrook for the purpose of providing efficient operation using less energy, as taught by Silverbrook.

Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Asaba in view of Cornell et al.

Asaba teaches every element of the instant claims except:

31. The printhead of claim 30 further comprising a passivation material deposited on the fuses wherein the passivation material (28) comprises a spun-on-glass material;

32. The printhead of claim 30 further comprising passivation layers deposited on the fuses, wherein the passivation layers (28) comprise at least one silicon dioxide layer and at least one spun-on-glass layer.

Nevertheless, Cornell et al. teach:

31. The printhead of claim 30 further comprising a passivation material deposited on the fuses (21), wherein the passivation material (28) comprises a spun-on-glass material (col 6, lns 1-13);

32. The printhead of claim 30 further comprising passivation layers deposited on the fuses, wherein the passivation layers (28) comprise at least one silicon dioxide layer and at least one spun-on-glass layer (col 6, lns 1-13).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Asaba by the aforementioned teachings of Cornell et al. for the purpose of improving the chip heater, as taught by Cornell et al.

Allowable Subject Matter

Claims 22-28, 36, 37, and 38 are allowed.

Claims 19 and 33-35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reasons for Indication of Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter. The following claimed combinations could not be found in the prior art:

19. The printhead of claim 14 wherein the semiconductor substrate has a thickness ranging from about 600 to about 650 microns;

22. An ink jet printhead having low flow resistance features comprising, a flow feature portion of a printhead attached to a semiconductor substrate containing ink ejectors, the flow feature portion containing ink channels and ink chambers, wherein the ink channels contain a tapered area adjacent an ink feed edge of the chip and a feed channel between the tapered area and the ink chambers, the tapered area having a first entrance width adjacent the ink feed edge of the chip and the feed channel having a second entrance width, wherein a ratio of the first entrance width to second entrance width ranges from about 2:1 to about 8:1;

23. The ink jet printhead of claim 22 wherein the tapered area has a first length and the feed channel has a second length, and wherein a ratio of the first length to the second length ranges from about 1:1 to about 7:1;

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24. The ink jet printhead of claim 23 further comprising a shelf length, the shelf length including an area between the ink feed edge of the chip and the tapered area, wherein the shelf length is less than about 29 microns in length;

25. The ink jet printhead of claim 22 further comprising a shelf length, the shelf length including an area between the ink feed edge of the chip and the tapered area, wherein the shelf length is less than about 29 microns in length;

26. The ink jet printhead of claim 22 wherein the ink chambers comprise chamber walls and the ink ejector is a heater resistor having a heater edge, and wherein a distance from the heater edge to the chamber wall around a periphery of the heater resistor is about 2 microns or less;

27. The ink jet printhead of claim 22 wherein the semiconductor substrate comprises a silicon chip made from a single crystal silicon wafer having a thickness ranging from about 500 to about 1000 microns (col 9, lns 5-13);

28. The ink jet printhead of claim 27 wherein the silicon wafer has a thickness ranging from about 680 to about 900 microns (col 9, lns 5-13);

33. The printhead of claim 29 wherein the FET's gate oxide thickness ranges from about 200 to about 400 Angstroms;

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34. The printhead of claim 33 wherein the CMOS logic devices' gate oxide thickness ranges from about 100 to about 200 Angstroms;

35. The printhead of claim 29 wherein the FET's have an on resistance of less than about $100,000 \text{ ohm-prn}^2/\text{A}$, where A is a surface area of each of the FET's;

36. An ink jet printhead comprising a semiconductor substrate containing an ink ejector thereon, the ink ejector having an ink contact surface, and a nozzle plate attached to the semiconductor substrate, wherein the nozzle plate contains ink ejection nozzles have a truncated substantially conical shape, a cone angle, an entrance, an

exit, a length between the entrance and exit, and a nozzle volume per unit length of greater than one defined by the length, cone angle, and cross-sectional area of the nozzle, and wherein a distance from the ink contact surface of the ink ejector to the exit of the nozzle is less than about 37 microns;

37. A semiconductor substrate for a micro-fluid ejection device comprising a silicon chip made from a single crystal silicon wafer wherein the wafer has a thickness ranging from about 500 to about 1000 microns and containing a plurality of ink ejection devices defined on a surface of the chip;

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38. A semiconductor substrate for a micro-fluid ejection device comprising a silicon chip made from a flexible single crystal silicon wafer wherein the wafer has a thickness ranging from about 50 to about 400 microns and containing a plurality of ink ejection devices defined on a surface of the chip.

Contact Information

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Raquel Y. Gordon, whose telephone number is (571) 272-2145. The Examiner can normally be reached on M Tu Th and F 8:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the Examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. A fax number is available upon request.

Any inquiry of a general nature or relating to the status of this application or proceeding may be directed to the Examiner or Supervisor.



Raquel Y. Gordon
Primary Examiner
Art Unit 2853
September 28, 2004

**RAQUEL GORDON
PRIMARY EXAMINER**